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An Approach to Ethical AI in the AEC/O Industry

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The Architecture, Engineering, Construction, and Operations (AEC/O) industry stands on the cusp of a transformative era, driven by the rapid evolution of Artificial Intelligence (AI). Beyond the familiar applications of smart assistants, the emergence of large foundation models is unlocking unprecedented capabilities. Imagine AI not just generating designs, but understanding complex project requirements, reasoning through intricate structural challenges, and even anticipating the emotional needs of building occupants. This revolution demands a thoughtful approach to ethical AI, ensuring that these powerful tools enhance, rather than replace, human expertise and creativity in architecture, engineering, construction, and operations.

CURRENT CAPABILITIES OF AI MODELS

Today, we can clearly see six stunning capabilities that are forming as AI models are growing larger:

» **Deep semantic understanding:** The ability to not just understand words but really get the deeper meaning out of complicated language and contexts. AI can analyze complex building codes, regulations, and client briefs to extract critical requirements and design constraints, ensuring compliance and optimizing project outcomes.

» **Complex reasoning:** The capacity to solve challenging problems and reason through them step by step. AI can optimize structural designs, analyze energy efficiency scenarios, and troubleshoot construction logistics by reasoning through complex variables and constraints.

» **Generalization:** Taking what the model learned to entirely new contexts. A model trained to generate building designs for skyscrapers may ultimately do well on bridges too.

» **Multimodality:** Combining text, images, audio, video, and sensor data into one model, so that the AI can read, see, hear and "feel" all at the same time. AI can analyze drone footage of construction sites, combine it with sensor data from building systems, and generate real-time reports on progress, safety, and performance.

» **Theory of mind:** AI is now able to "understand" the emotions and state of mind of the person interacting with it. You know that feeling when you call an automated customer service line in a bad mood, and you have to listen to a cheerful automated voice system? That will get much better soon. As an example, AI-powered building management systems will adjust lighting, temperature, and ventilation

based on occupant preferences and emotional cues, creating more comfortable and productive environments.

» **Goal pursuit:** This is about not only handing over small, individual tasks to an AI, but instead having its own entire goals. If you wanted to get a dentist appointment, you would simply ask your AI assistant to get one booked – and it will be able to find a dentist, an appointment that fits your schedule, and arrange your trip to the dentist.

Now, these six capabilities are amazing on their own – but imagine them coming together in your smartphone, your home, and, yes, in your architecture software over the coming years. It will be transformative on the widest scale.

There are two very important points to be clear, however: First, the future is not AI-driven mass production – the future is 100x higher quality, in every sense. Secondly, the future is not replacing humans with AI, it is assisting humans and upleveling our creativity and productivity in unimaginable ways.

ETHICAL CHALLENGES

So, while there's no denying that the AEC/O sector is on the verge of a massive digital transformation, driven primarily by advancements in artificial intelligence (AI), its implementation in the AEC/O industry comes with an equally unprecedented set of challenges. An ethical and responsible use of, and approach to, these technologies is paramount to ensuring a successful and sustainable transformation.

It's important to consider a few key risk factors that AEC/O professionals face when integrating AI-powered technologies.

» **Data Privacy and Security:** AI's ability to maximize creativity and optimize design generation is bound to result in a significant increase in innovation. Protecting new proprietary models and intellectual property (IP) created with AI is both increasingly important and complex, particularly as policymakers grapple with the implications of AI for IP ownership and infringement. Moreover, in most AEC/O use cases, the utilization of AI necessarily involves data collection, analysis, and management, the machinery in use, and virtually all other aspects of the building lifecycle. Safeguarding such sensitive data is vital. Cybersecurity attacks and data breaches are on the rise across the digital ecosystem, including identity theft targeting individual workers, as well as the financial extortion of entire organizations through the seizure of sensitive project data and critical operational systems – protecting project data and operational systems from such breaches and ransomware attacks becomes a critical priority.

» **Safety:** Construction sites are inherently complex and high-risk environments for workers even without AI, and ensuring structural integrity is imperative for protecting the welfare of building occupants. Companies should advocate for rigorous testing, validation, and real-time oversight to ensure AI systems contribute to safer, more reliable outcomes. AI should empower professionals rather than replace their critical judgment.

» **Business Integrity and Compliance:** The misuse of AI systems and AI-generated content can result in financial losses as well as costly legal challenges and irreparable damage to a company's reputation. A proactive approach is necessary, including implementing robust frameworks for safe AI integration, while maintaining a keen eye on increasingly complex and constantly evolving policies and regulatory requirements.

In regulating ethical AI tools, the European Union leads globally with its AI Act, making it the first comprehensive, enforceable AI-focused regulation. It emphasizes a "human-centric" approach to ethical AI use and sustainability. AI policy in the US has recently shifted with the revoking of the 2023 executive order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence. Countries including China, Singapore, and India are also advancing to find a unique balance between fostering innovation and mitigating potential risks.

CONCLUSION

While nations figure out this unpaved path, it's critical for the AEC/O industry to proactively adopt ethical, responsible AI practices, leveraging all relevant existing and emergent frameworks to shape future compliance initiatives. Continued dedication and comprehensive approach to ethical AI deployment and development will ensure that the AEC/O industry's innovative future comes not at the expense but to the benefit of our environments and society at large.

About the Author

Julian Geiger is Vice President of AI Product and Transformation at the Nemetschek Group. He leads the development and adoption of AI capabilities across the Nemetschek Group to drive customer value and increase internal productivity. His comprehensive approach spans digital strategy, technology platforms, business processes, and organizational culture.

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